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Prediction of the Local Glass Transition Temperature of Polystyrene and Poly(Methyl Methacrylate) Bilayer Thin Films[1] DAVID HSU, Wheaton College, WENJIE XIA, JAKE SONG, SINAN KETEN, Northwestern University — The local glass transition (T_g)-nanoconfinement effect is characterized at nanometer resolution at polymer-substrate, polymer-vacuum, and polymer-polymer interfaces for freestanding, supported, and bilayer films. The interphase T_g-profile, is size-independent above a critical thickness and can be approximated by exponential functions. Below the critical thickness where interphase regions overlap, the T_g -profile follows the superposition of exponentials. For an 18 nm PS thin film overlayer with a PMMA underlayer supported by an attractive substrate, the free surface effect is found to be effectively eliminated for all underlayer thicknesses due to the enhanced local T_g near the PMMA-PS interface which cancels out the T_g depression effect near the free surface. At very low PMMA thicknesses, the PMMA-substrate effect is able to penetrate through the soft polymer-polymer interface and causes the PS layer T_g to appreciate. Local analytical functions are then applied to a freestanding PMMA-PS bilayer nanocomposite system with a cylindrical nanorod. The predicted spatial T_g shows relatively good comparison with simulated results, verifying the universality of the superposition principle.

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